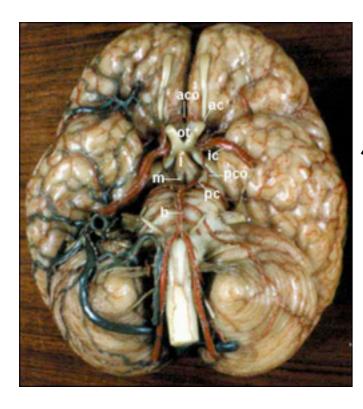# NeuroBlocks - Visual Tracking of Segmentation and Proofreading for Large Connectomics Projects

Presented by Ben Bougher
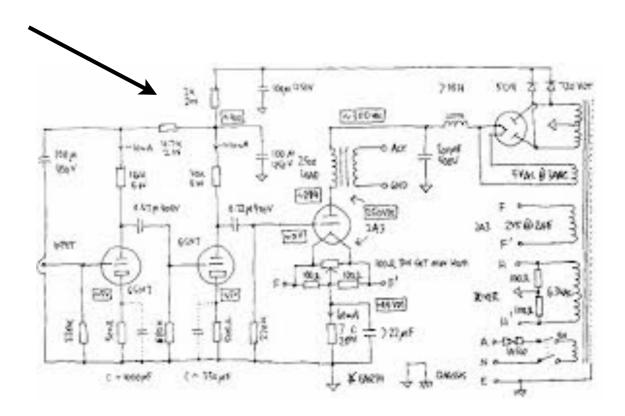
1

Connectomics?

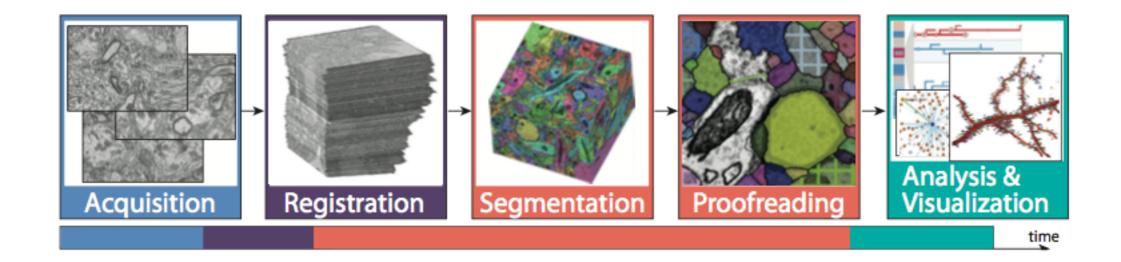- A perfectly cromulent field of research

Connectronix

Connectometry

Connectometry

Acquisition → Registration → Segmentation → Proofreading → Analysis & Visualization
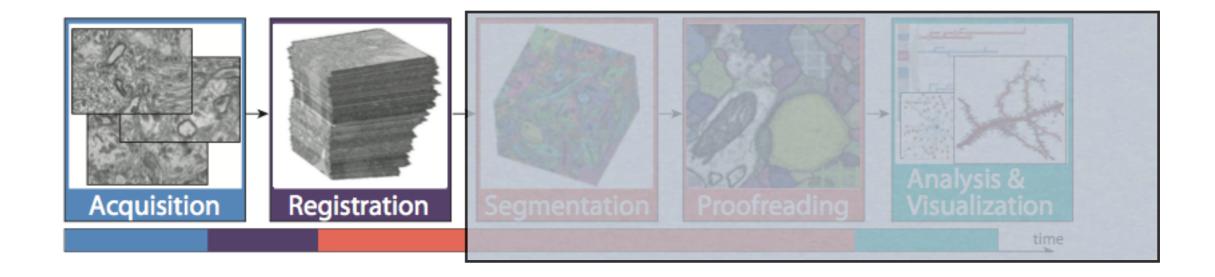
time

Slice up the brain

Electron microscope imaging

    ~ nm resolution!

Form images into volumetric data

    ~100 TB!

5

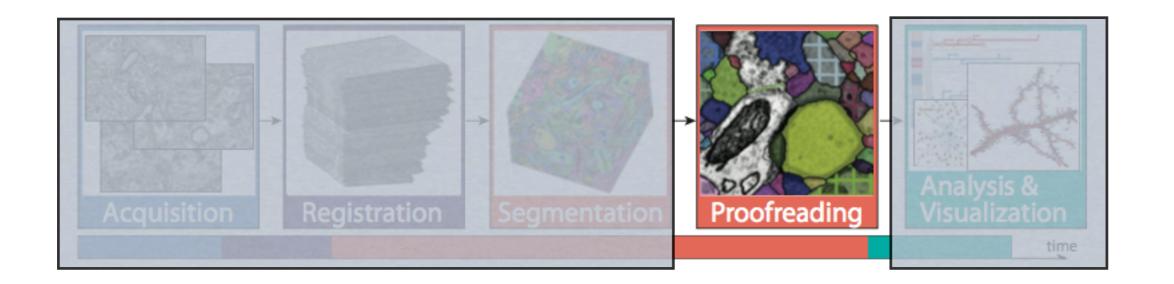Segment the key neuron components in the image

    ie dendrites, axons,

Manually segment (~100 TB!)

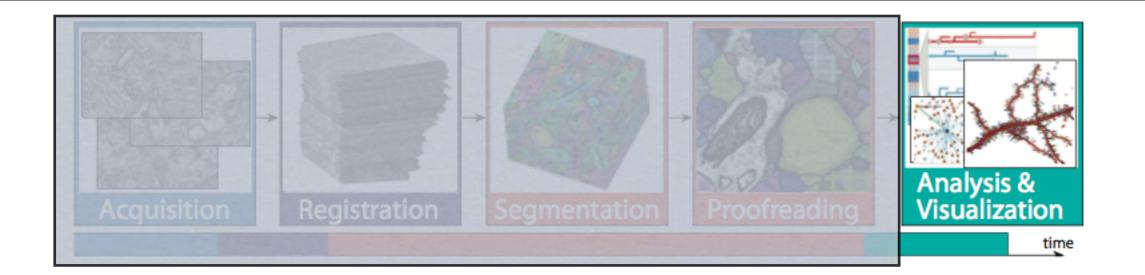   Grad students, "interns", large spread of experience

Automatically segment

    Algorithms always require baby sitting
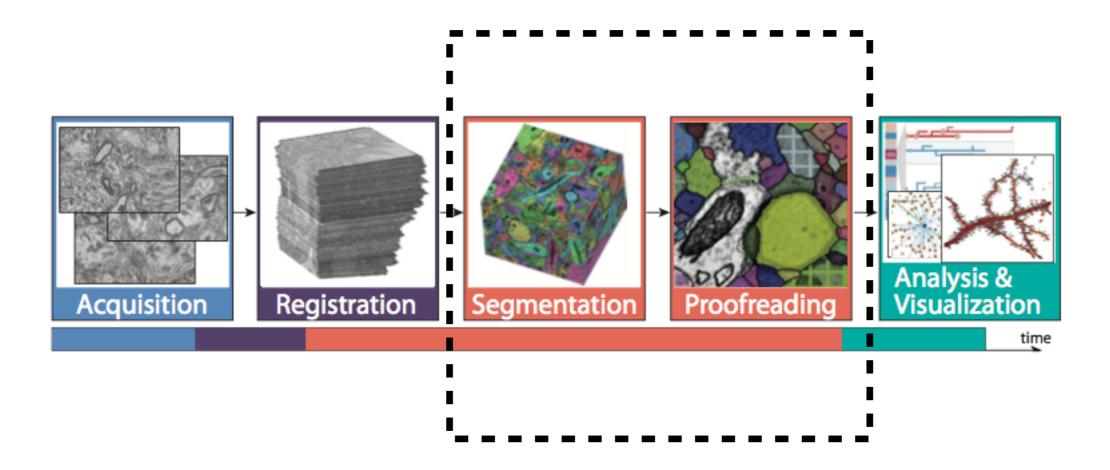
Students are bad, automated algorithms worse

The segmented volumes need to be verified by domain experts (~100 TB!)

Acquisition → Registration → Segmentation → Proofreading → **Analysis & Visualization**

time

Segmented volumes are analyzed and synapses can be traced out based on connected segments

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Bottleneck

Acquisition → Registration → Segmentation → Proofreading → Analysis & Visualization

time

*Most time intensive

Why?

NeuroBlocks Goals

Interactive visualization-driven framework for managing the state and progress of a individual segmentation projects.

Requirements:

see the current segmentation

track its evolution

manage users and their individual progress

create tasks and track their project

integrate with 3rd party tools

Tasks

Overview and detailed views of current segmentation (explore)

Track changes (provenance)

Manage segmentation tasks (task manager)

Audit users and segmentations (user manager)

Switch seamlessly between 3rd party tools (integration)

| explore | provenance | task mgmt | user mgmt | integration |

Video

- http://vcg.seas.harvard.edu/files/pfister/files/vis15_neuroblocks.mp4?m=1440702700
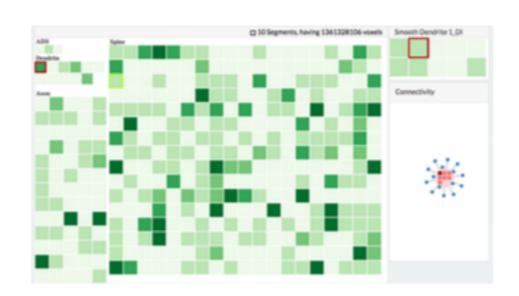
Pixel view

Abstracts a segment into a pixel

Uses colour to *encode* activity

Aggregates large datasets by combining pixels into a "super pixel"

Filters segments based on *attributes*, encourages auditing
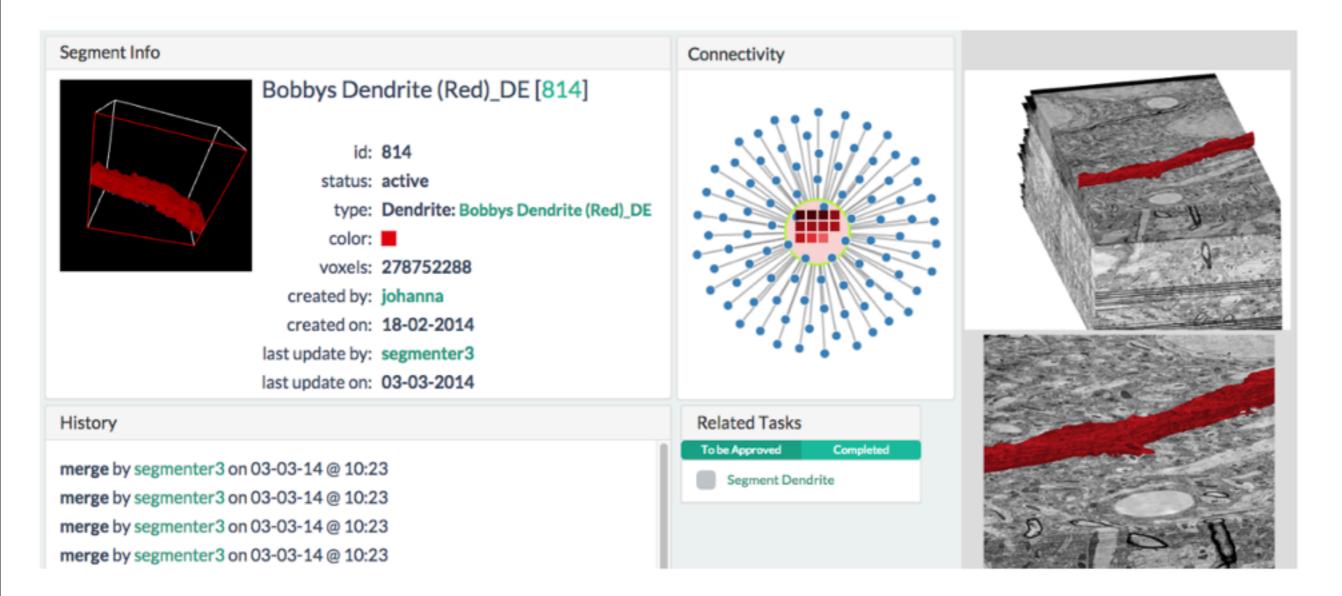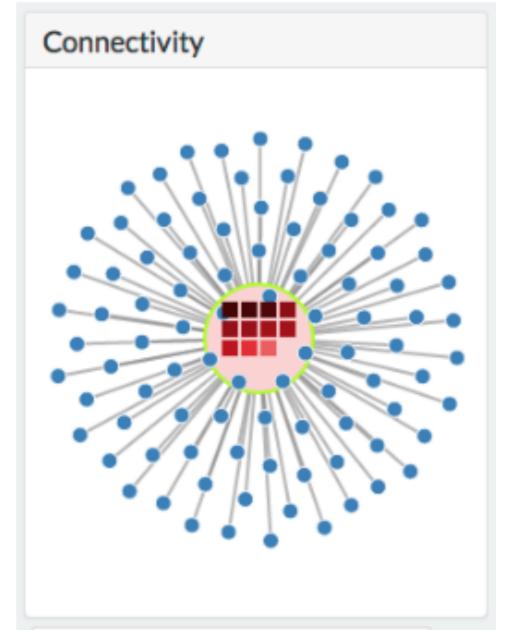
Timeline viz via *sliders* and *brushes*

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Detail view

Connectivity view

Some *abstraction* in the connectivity plot.

The middle "node" is an object, which is a group of "segments", and the coloured squares encode what segments are in the object.

The outer nodes are connected nodes, however the spatial channel encodes no information.

Connectivity
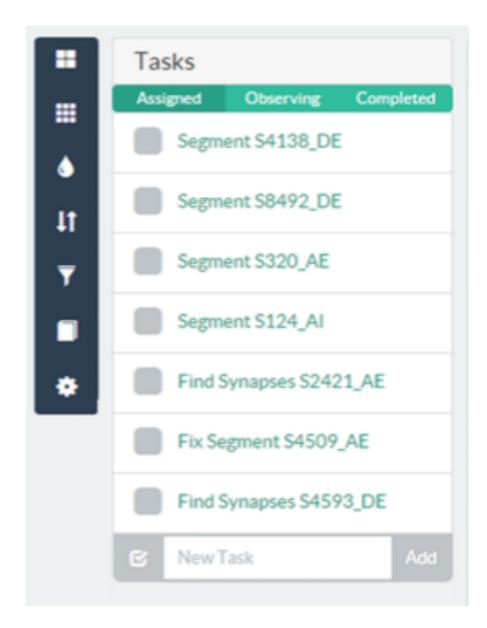
16

| explore | provenance | task mgmt | user mgmt | integration |

Task view

yep, they have one

Tasks

| Assigned | Observing | Completed |

☐ Segment S4138_DE

☐ Segment S8492_DE

☐ Segment S320_AE

☐ Segment S124_AI

☐ Find Synapses S2421_AE

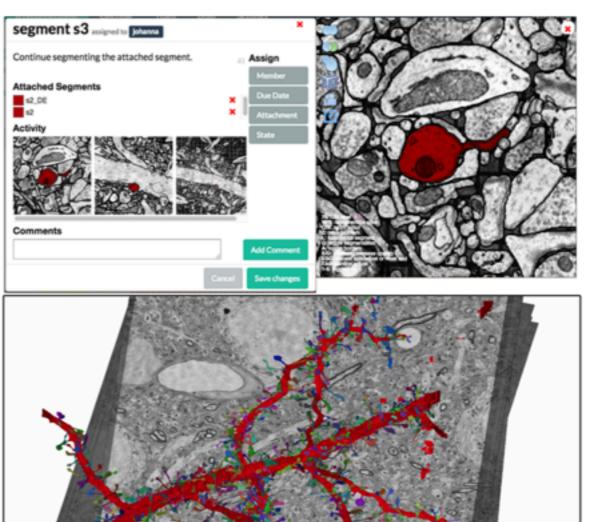☐ Fix Segment S4509_AE

☐ Find Synapses S4593_DE

New Task   Add

17

Integration

API's so 3rd party tools can "plug in"

Demonstrated this with their own 3D rendering plugins

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Validation?

explore	provenance	task mgmt	user mgmt	integration

Covered their tasks and met their domain goals

NeuroBlocks was used in 2 case studies

General management of a project

Proof reading automated segments

Qualitative Feedback

Interoperability had the biggest impact

All tools in one place, common formats, all activities write to the same database

Questions?

- ?